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Temperature and time required to kill.

Material.	20 C. (68 F.)	36 C. (96.8 F.)	60 C. (140 F.)	80 C. (176 F.)
	Days.	*Days.*	*Minutes.*	*Minutes.*
Silk thread	19 to 24	13	75	15
Note paper	10 to 17	5	30	15
Filter paper	10 to 24	7	45	15
Linen thread	9 to 13	4	30	15
Woolen thread	13 to 23	5	60	15

VIABILITY ON VARIOUS OBJECTS.

In sputum kept fluid, the GERMAN PLAGUE COMMISSION(*a*) found the bacillus of pest infectious after ten days.

HANKIN (*b*) made researches on various articles of produce to determine their susceptibility to endanger or support the bubonic microbe. He shows that the various descriptions of flours and grain usually stored in Bombay contain no trace of the bubonic microbe and also demonstrates that grain purposely infected does not permit of the existence of the microbe for more than about four days.

Hankin worked with linseed, yellow rape seed, brown rape seed, tilseed or ginjelly seed, ground nuts, castor seeds, poppy seeds, wheat (new hard red), wheat (another light variety), flour.

In order to test whether the microbe was still present in a living condition in a specimen of previously infected grain his method consisted of making an extract of this grain and injecting it into a mouse.

He used agar cultures making bouillon suspensions. About a kilogram of grain to be tested was placed in a sterile stoppered foot glass. One c. c. of the bouillon emulsion of the microbe was then poured into the foot glass, care being taken that it should fall into the center of the grain. The stopper was replaced and the foot glass was immediately violently shaken for about one-quarter of an hour.

Extracts made from the grain in this manner were inoculated into mice with the following results:

Extract of the following injected into mice.	At once after infecting the grain.	Two days after infecting the grain.	Four days after infecting the grain.	Eleven days after infecting the grain.	Thirteen days after infecting the grain.
Linseed	Died within 24 hours.	Died after 7 days.	Died after 15 days.	Survived	Survived.
Yellow rape seed	Died within 72 hours	Died after 24 hours.	Survived	do	Died after 24 hours.
Brown rape seed	Died within 48 hours.	Died after 4 days.	do	Died after 24 hours.	Survived.
Tilseed	Died within 24 hours.	Survived	do	Died after 7 days.	Do.
Ground nuts	do	Died after 11 days.	do	Died after 24 hours.	Do.
Poppy seed	do	Died after 48 hours.	do	do	Do.
Wheat (new hard red).	Died within 48 hours.	Survived	do	do	Do.
Wheat (another kind).	Survived	do	do	do	Do.
Flour	Died within 48 hours	Died after 48 hours.	do	do	Do.

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a Kaiserliche Gesundheitsamte, Bd. 16, Berlin, 1899.

b The Plague in India, 1896, 1897, Vol. II, Appendices I-IV, page 10 *et seq.*

Hankin concludes from these experiments that the bubonic microbe derived from pure cultures perishes within thirteen days after being added to the above-mentioned specimens of grain and seeds.

Further experiments were made with grain and seeds by mixing the spleen of a rat and the liver, spleen, and œdema from a mouse, both animals having died after plague infection, instead of cultures of the organism. The organs were powdered up in a mortar with powdered glass and mixed with bouillon and added to the grain and seed. The further proceedings were as above.

The result of this showed that grain infected with the organs of animals dead of the plague lost its infectious power completely within six days.

Another set of experiments was then conducted by infecting the grain with sputum from a case of pneumonic plague. Sputum was taken, in which the organism was demonstrated to exist in large numbers in very virulent condition.

These also showed the plague infection to die out from all the variety of seed and grain tested within six days.

ABEL (*a*) found living bacilli of plague in water after twenty days. He added an œse to 50 cc. of sterile distilled and tap water.

The GERMAN PLAGUE COMMISSION (*b*) found that the organism was no longer virulent after five days in tap and ten days in distilled water.

YOKOTE (*c*) worked on the problem of how long the plague bacillus can remain alive in the dead body. He used mice for his experiments because they are very susceptible. The mice were inoculated and the presence of the bacilli demonstrated in the heart's blood of the dead animals, which were then placed in a wooden casket. Each casket was covered with a lid and then buried in a metal box filled with garden earth. From time to time water was poured on the earth so that it always had a certain moisture. The temperature of the room was taken daily. After a certain time the bodies were disinterred, the amount of moisture present in the earth surrounding the casket determined quantitatively, also examined bacteriologically and by animal experiments for pest bacilli. Mice were used for this purpose, and glycerin agar for culture medium.

On disinterring the body the amount of decomposition was noted, and by means of cover glass prepartions he determined the characters and numbers of micro-organisms present in the various organs. Plate cultures were made from the internal organs, on agar-agar, and some of the heart's blood, liver, or in case of advanced decomposition, some of the remains were inoculated into mice subcutaneously.

As a result of these experiments, he concludes that the pest bacillus loses its life and its power of infection in a relatively short time. It

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a Loc cit. *b* Loc cit.

c Uber die Lebensdauer der Pestbacillen in der beerdigten Tierleiche. Dr. Z. Yokote. Centralblatt für Bakteriologie und Parasitenkunde, etc., Vol. XXIII, 1898, No. 24, page 1030.

remains alive, at most, twenty to thirty days. This depends on the temperature. The higher the temperature, the stronger the decomposition, the shorter the life of the bacillus. In summer many saprophytes grow in the body and cause products which kill the pest bacillus. In cold winter this growth of saprophytes is less, and the pest bacillus could therefore live and maintain its virulence a longer time.

He states that his experiments are not sufficient to determine positively the length of time the pest bacillus may live in a buried body, but he gives it as his belief that the organism can not live longer in the cadaver than spore-bearing organisms because it does not have spores. It is also of interest to notice that the pest bacillus did not escape from the wooden casket into the surrounding earth. It seems, therefore, that there is no danger in the burial of pest cadavers of infecting the surrounding earth as long as the coffin is tight.

THE LENGTH OF TIME THE PEST BACILLUS WITHSTANDS DRYING.

Author.	Conditions.	Resisted.	Killed.
Kitisato	Dried on cover glass slips at 28° to 30° C.	1 to 36 hours	4 days.
Wilm.	Dried on glass slips at 29° to 31° C.	4½ days	After 4½ days.
	Dried in vacuo		3 hours.
Abel	Dried on various objects at 35° C.		2 to 4 days.
	Dried on various objects in vacuo over H_2SO_4 at 20° C.		2 to 4 days.
	Dried on cover slips from pus and culture at 16° to 20° C.	14 days	After 14 days.
	Dried on threads, in linen, in tissue at 16° to 20° C.	30 days	
	Dried piece of fresh skin, 16° to 20° C.	10 days	
Ficker	Dried on cover glasses in desiccator	8 to 11 days	9 to 12 days.
	Dried and moistened alternately	20 to 36 hours	28 to 48 hours
Batzaroff	Dried splenic pulp, "room temperature."	28 days	44 days.
	Dried cultures mixed with infusorial earth.	19 days	31 days.
Hankin	Dried on sheep's wool, and gunny cloth and cotton.		6 days.
German Plague Commission.	Dried on glass, filter paper, silk threads, pieces of silk and wool and linen, at 30° to 32° C. exposed both in room and in desiccator.	7 days.	
	Dried on the same objects at 30° and 32° C., and 22° to 24° C., infected with bacillus from plague organs.	8 days.	
	Dried and kept at 15° to 18° C.	28 days	33 days.
Germano	In moist and dry room dust, 16° to 20° C.		1 day.
	Dried in fine sand and brick dust, 16° to 20° C.	1 day	5 days.
	Dried in loam, tufa, and marl		1 day.
	In moist sand, loam, tufa, marl, and brick dust at 16° to 20° C.	60 days.	
	On moist linen, wool, silk, and filter paper at 16° to 20° C.	60 days.	
	Dried on linen, 16° to 20° C.	1 day	4 days.
	Dried on wool, 16° to 20° C.	30 days.	
	Dried on silk, 16° to 20° C.	4 days	8 days.
	Dried on filter paper	4 days.	
Giaxa and Gosio	Dried on linen and wool; agar cultures, pus and blood used. 10° to 13° C.	30 days	
	Dried on linen thread, 36° to 39° C.	4 days	5 days.
	Rabbit skin infected with plague-infected blood, 12° to 16° C.	15 days	
Rosenau	Dried on little balls of gelatin-albumen, 20° to 23° C.	75 days	
	Dried on little balls of gelatin-albumen, 17° to 19° C.	75 days	
	Dried on crash, 17° to 19° C. and 20 to 23° C.	48 days	
	Dried on crash, 20° to 27° C.	13 days	15 days.
	Dried on paper, 20° to 27° C	8 days	11 days.
	Dried on pine wood, 20° to 27° C.	4 days	8 days.
	Dried on pine wood, 17° to 19° C.	8 days	11 days.
	Dried on pine wood, 20° to 23° C.	11 days	13 days.

EFFECT OF SUNLIGHT ON PLAGUE BACILLI.

Author.	Condition.	Killed.	Withstood.
			Hours.
Abel	In Hamburg, 30 C., thin spreads on cover glasses	1 hour.	
	Thicker spreads		3½
Kitasato	In Hongkong. Pus from buboes	3 to 4 hours	
Wilm		4 hours	
Albrech and Bhon	Vienna in August, peritoneal exudate		6
German Pest Commission	In Bombay, thin layers on glass	1 hour	
	thicker layers on glass	4 hours	3
	silk threads	3 hours	
	in wool		8
	agar test tube culture	All day	2
Rappoport	In St. Petersburg, silk threads, 20 C	24 days	
	note paper, 20 C.	17 days	
	filter paper, 20 C	24 days	
	linen thread, 20 C	13 days	
	woolen thread, 20 C	23 days	

VIABILITY OF THE ORGANISM IN VARIOUS MEDIA.

Author.	Condition.	Alive.	Dead.
		Days.	*Days.*
German Plague Commission	In sputum, 30° to 32° C	6 to 10	
	In pieces of liver kept in sealed tube	7	(a)
	In sterilized feces in thread, fabrics, and paper, 29° C.	4	8
Hankin	On seeds, grains, and flours		13
Abel	In water, distilled and tap	20	
German Plague Commission	In tap water		5
	In distilled water		10
Yokoto	In cadavers of mice, buried	20 to 30	

(a) After 7 days.

Plague in San Francisco.

The following telegraphic communications sent to and received by the Surgeon-General of the U. S. Marine-Hospital Service explain the status of the plague situation in San Francisco from March 8, when first case was announced, until May 21:

ANGEL ISLAND, CAL., *March 8, 1900.*

Case of alleged plague in Chinatown reported. City bacteriologists bring me specimens for examination. Animals inoculated this afternoon. So far no one has obtained history of case. Chinese Six Companies have undertaken investigation previous history suspect.

KINYOUN.

The SURGEON-GENERAL,
U. S. Marine-Hospital Service.

ANGEL ISLAND, CAL., *March 8, 1900,*
via San Francisco, Cal., March 8, 1900.

History of suspect obtained through Chinese consul and Six Companies shows that case was resident of city sixteen years. Sick since February 7 with specific disease. No developments so far in animals inoculated.

KINYOUN.

The SURGEON-GENERAL,
U. S. Marine-Hospital Service.